Complete Summary

GUIDELINE TITLE

Suspected liver metastases.

BIBLIOGRAPHIC SOURCE(S)

Heiken JP, Bree RL, Foley WD, Gay SB, Glick SN, Huprich JE, Levine MS, Ros PR, Rosen MP, Shuman WP, Greene FL, Expert Panel on Gastrointestinal Imaging. Suspected liver metastases. [online publication]. Reston (VA): American College of Radiology (ACR); 2005. 8 p. [28 references]

GUIDELINE STATUS

This is the current release of the guideline.

This guideline updates a previous version: Bree RL, Greene FL, Ralls PW, Balfe DM, DiSantis DJ, Glick SN, Kidd R, Levine MS, Megibow AJ, Mezwa DG, Saini S, Shuman WP, Laine LA, Lillemoe K. Suspected liver metastases. American College of Radiology. ACR Appropriateness Criteria. Radiology 2000 Jun;215(Suppl):213-24.

The appropriateness criteria are reviewed annually and updated by the panels as needed, depending on introduction of new and highly significant scientific evidence.

COMPLETE SUMMARY CONTENT

SCOPE

DISEASE/CONDITION(S)

Liver metastases

GUIDELINE CATEGORY

Diagnosis

CLINICAL SPECIALTY

Gastroenterology
Internal Medicine
Nuclear Medicine
Oncology
Radiology

INTENDED USERS

Health Plans
Hospitals
Managed Care Organizations
Physicians
Utilization Management

GUIDELINE OBJECTIVE(S)

To evaluate the appropriateness of initial radiologic examinations for patients suspected of liver metastases

TARGET POPULATION

Patients with suspected liver metastases

INTERVENTIONS AND PRACTICES CONSIDERED

1. Computed tomography (CT)
    - Abdominal CT without contrast
    - Helical CT in portal venous phase (PVP)
    - Helical in hepatic arterial phase (HAP) and PVP
    - Helical without contrast followed by HAP and PVP
    - Computed tomography arterial portography (CTAP) or computed tomography angiography (CTA)
2. Magnetic resonance imaging (MRI)
    - Abdominal spin-echo MRI then gradient-echo magnetic resonance imaging with extracellular contrast media (e.g., gadolinium chelates)
    - Abdominal spin-echo MRI without contrast
    - Abdominal MRI with reticulo-endothelial contrast (e.g., iron-oxide)
3. Ultrasound (US)
    - Abdominal US
    - Abdominal US with color Doppler
    - Intraoperative/laparoscopic abdominal US
4. Nuclear imaging
    - Radionuclide liver scan with reticulo-endothelial agent
    - Nuclear medicine (NUC), immunoscintigraphy
    - Positron emission tomography (PET)

- Radionuclide liver scan with blood pool agent
- Somatostatin receptor imaging

5. Hepatic angiography with or without CTAP or CTA
6. Image-guided biopsy of liver

MAJOR OUTCOMES CONSIDERED

Utility of radiologic examinations in differential diagnosis

METHODOLOGY

METHODS USED TO COLLECT/SELECT EVIDENCE

Searches of Electronic Databases

DESCRIPTION OF METHODS USED TO COLLECT/SELECT THE EVIDENCE

The guideline developer performed literature searches of peer-reviewed medical journals, and the major applicable articles were identified and collected.

NUMBER OF SOURCE DOCUMENTS

The total number of source documents identified as the result of the literature search is not known.

METHODS USED TO ASSESS THE QUALITY AND STRENGTH OF THE EVIDENCE

Weighting According to a Rating Scheme (Scheme Not Given)

RATING SCHEME FOR THE STRENGTH OF THE EVIDENCE

Not stated

METHODS USED TO ANALYZE THE EVIDENCE

Systematic Review with Evidence Tables

DESCRIPTION OF THE METHODS USED TO ANALYZE THE EVIDENCE

One or two topic leaders within a panel assume the responsibility of developing an evidence table for each clinical condition, based on analysis of the current literature. These tables serve as a basis for developing a narrative specific to each clinical condition.

METHODS USED TO FORMULATE THE RECOMMENDATIONS

Expert Consensus (Delphi)

DESCRIPTION OF METHODS USED TO FORMULATE THE RECOMMENDATIONS

Since data available from existing scientific studies are usually insufficient for meta-analysis, broad-based consensus techniques are needed for reaching agreement in the formulation of the appropriateness criteria. The American College of Radiology (ACR) Appropriateness Criteria panels use a modified Delphi technique to arrive at consensus. Serial surveys are conducted by distributing questionnaires to consolidate expert opinions within each panel. These questionnaires are distributed to the participants along with the evidence table and narrative as developed by the topic leader(s). Questionnaires are completed by the participants in their own professional setting without influence of the other members. Voting is conducted using a scoring system from 1 to 9, indicating the least to the most appropriate imaging examination or therapeutic procedure. The survey results are collected, tabulated in anonymous fashion, and redistributed after each round. A maximum of three rounds is conducted and opinions are unified to the highest degree possible. Eighty (80) percent agreement is considered a consensus. This modified Delphi technique enables individual, unbiased expression, is economical, easy to understand, and relatively simple to conduct.

If consensus cannot be reached by this Delphi technique, the panel is convened and group consensus techniques are utilized. The strengths and weaknesses of each test or procedure are discussed and consensus reached whenever possible. If "No consensus" appears in the rating column, reasons for this decision are added to the comment sections.

RATING SCHEME FOR THE STRENGTH OF THE RECOMMENDATIONS

Not applicable

COST ANALYSIS

A formal cost analysis was not performed and published cost analyses were not reviewed.

METHOD OF GUIDELINE VALIDATION

Internal Peer Review

DESCRIPTION OF METHOD OF GUIDELINE VALIDATION

Criteria developed by the Expert Panels are reviewed by the American College of Radiology (ACR) Committee on Appropriateness Criteria.

RECOMMENDATIONS

MAJOR RECOMMENDATIONS

ACR Appropriateness Criteria®

Clinical Condition: Suspected Liver Metastases

Variant 1: Initial Imaging test following detection of primary tumor.

Radiologic Exam Procedure	Appropriateness Rating	Comments
CT, abdomen, helical in PVP	8	
CT, abdomen, helical in HAP and portal venous phase (PVP)	8	HAP imaging is useful for patients with a hypervascular primary tumor such as (but not limited to) renal cell, pancreatic islet cell, and thyroid carcinoma; carcinoid and other neuroendocrine tumors; and melanoma.
CT, abdomen, helical without contrast followed by HAP and PVP	6	HAP imaging is useful for patients with a hypervascular primary tumor such as (but not limited to) renal cell, pancreatic islet cell, and thyroid carcinoma; carcinoid and other neuroendocrine tumors; and melanoma.
MRI, abdomen, spin-echo then gradient-echo with extracellular contrast e.g. gadolinium chelates	6	
PET	6	
MRI, abdomen, with reticulo-endothelial contrast e.g., iron-oxide	5	
CT, abdomen, without contrast	4	
MRI, abdomen, spin-echo, without contrast	4	
US, abdomen	4	
US, abdomen, with color Doppler	4	
NUC, liver scan with reticulo-endothelial agent	4	
NUC, Immunoscintigraphy	3	

Radiologic Exam Procedure	Appropriateness Rating	Comments
CTAP or CTA	2	
NUC, liver scan with blood pool agent	2	
Somatostatin receptor imaging	2	
INV, hepatic angiography with or without CTPA or CTA	2	
Appropriateness Criteria Scale 1 2 3 4 5 6 7 8 9 1 = Least appropriate 9 = Most appropriate		

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 2: Surveillance following treatment of primary tumor.

Radiologic Exam Procedure	Appropriateness Rating	Comments
CT, abdomen, helical in PVP	8	
CT, abdomen, helical without contrast followed by HAP and PVP	8	HAP imaging is useful for patients with a hypervascular primary tumor such as (but not limited to) renal cell, pancreatic islet cell, and thyroid carcinoma; carcinoid and other neuroendocrine tumors; and melanoma.
CT, abdomen, helical in HAP and PVP	8	HAP imaging is useful for patients with a hypervascular primary tumor such as (but not limited to) renal cell, pancreatic islet cell, and thyroid carcinoma; carcinoid and other neuroendocrine tumors; and melanoma.
MRI, abdomen, spin-echo then gradient-echo with extracellular contrast e.g., gadolinium chelates	6	
PET	6	

Radiologic Exam Procedure	Appropriateness Rating	Comments
MRI, abdomen, with reticulo-endothelial contrast e.g., iron-oxide	5	
CT, abdomen, without contrast	4	
MRI, abdomen, spin-echo, without contrast	4	
US, abdomen	4	
US, abdomen, with color Doppler	4	
NUC, liver scan with reticulo-endothelial agent	4	
NUC, Immunoscintigraphy	4	
Somatostatin receptor imaging	4	
CTAP or CTA	2	
US, abdomen, intraoperative/laparoscopic	2	
NUC, liver scan with blood pool agent	2	
INV, hepatic angiography with or without CTAP or CTA	2	
Appropriateness Criteria Scale 1 2 3 4 5 6 7 8 9 1 = Least appropriate 9 = Most appropriate		

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 3: Abnormal surveillance US, CT, or MRI in PVP: high suspicion of malignancy.

Radiologic Exam Procedure	Appropriateness Rating	Comments
INV, liver, image-guided biopsy	8	

Radiologic Exam Procedure	Appropriateness Rating	Comments
CT, abdomen, helical in HAP and PVP	8	HAP imaging is useful for patients with a hypervascular primary tumor such as (but not limited to) renal cell, pancreatic islet cell, and thyroid carcinoma; carcinoid and other neuroendocrine tumors; and melanoma.
MRI, abdomen, spin-echo then gradient-echo with extracellular contrast e.g., gadolinium chelates	7	
PET	7	
MRI, abdomen, without contrast	4	
MRI, abdomen, with reticulo-endothelial contrast e.g., iron-oxide	4	
CT, abdomen, helical without contrast followed by HAP and PVP	4	HAP imaging is useful for patients with a hypervascular primary tumor such as (but not limited to) renal cell, pancreatic islet cell, and thyroid carcinoma; carcinoid and other neuroendocrine tumors; and melanoma.
US, abdomen	4	
US, abdomen, with color Doppler	4	
US, abdomen, intraoperative/laparoscopic	4	
CTAP or CTA	3	
NUC, liver scan with reticulo-endothelial agent	3	
NUC, liver scan with blood pool agent	3	
Somatostatin receptor imaging	3	
NUC, Immunoscintigraphy	3	
INV, hepatic angiography	3	

Radiologic Exam Procedure	Appropriateness Rating	Comments
with or without CTAP or CTA		
CT, abdomen, without contrast	2	
Appropriateness Criteria Scale 1 2 3 4 5 6 7 8 9 1 = Least appropriate 9 = Most appropriate		

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 4: Abnormal surveillance US, CT, or MRI in PVP: high suspicion of benignancy.

Radiologic Exam Procedure	Appropriateness Rating	Comments
MRI, abdomen, spin-echo then gradient-echo with extracellular contrast e.g., gadolinium chelates	8	
CT, abdomen, helical in HAP and PVP	7	
MRI, abdomen, spin-echo, without contrast	5	
CT, abdomen, helical without contrast followed by HAP and PVP	5	
INV, liver, image-guided biopsy	4	
MRI, abdomen, with reticulo-endothelial contrast e.g., iron-oxide	4	
US, abdomen	4	
US, abdomen, with color Doppler	4	
NUC, liver scan with reticulo-endothelial agent	4	
NUC, liver scan with blood	4	May be indicated with large lesion

Radiologic Exam Procedure	Appropriateness Rating	Comments
pool agent		with high suspicion of hemangioma.
CTAP or CTA	3	
US, abdomen, intraoperative/laparoscopic	3	
Somatostatin receptor imaging	3	
CT, abdomen, without contrast	2	
NUC, Immunoscintigraphy	2	
PET	2	
INV, hepatic angiography with or without CTAP or CTA	2	
Appropriateness Criteria Scale 1 2 3 4 5 6 7 8 9 1 = Least appropriate 9 = Most appropriate		

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

In the United States, metastatic disease is the most common cause of malignancy in the liver and is 20 to 50 times more common than primary liver cancer. The colon, stomach, pancreas, and breast are the most common primary sites. The appearance of a new lesion in the liver in a patient with a history of cancer strongly suggests hepatic metastasis. On the other hand, most small (1-1.5 cm) liver lesions, even in patients with known malignancy, are not malignant, especially if there are fewer than five lesions. In most series, about one-third of patients who die with a malignancy have liver involvement.

The liver is susceptible to metastatic disease primarily due to the nature of the endothelial lining. The dual blood supply to the liver has an effect on the vascularity of liver metastases, with those supplied by the hepatic arterial system being more vascular than those supplied by the portal venous system. Most gastrointestinal cancer is spread through the portal venous system, whereas other tumors are spread through the hepatic arterial system. Numerous imaging methods are available for detecting intrahepatic metastatic disease before, during, and after definitive therapy for the primary lesion. The usefulness of various imaging modalities can vary significantly across institutions because of local radiological expertise, availability of equipment or personnel, and the wishes and biases of treating physicians and radiologists. This review will attempt to identify the broad variety of available imaging tests so that each can be rated by the

consensus panel, realizing that many published scientific studies do not compare all imaging modalities at the current state of the art.

Ultrasound

Ultrasound (US) is the most available technique for liver imaging worldwide, and in many countries is the major modality used to search for liver metastases. In the United States, the relative availability of computed tomography (CT) and magnetic resonance imaging (MRI) and limited physician involvement in the performance of US, contribute to a lesser role for US diagnosis. Many patients have liver masses detected by US when suspicion of metastases is not high. In general, in the United States pretreatment and post-treatment screening for metastases is performed less often with US. Comparative studies demonstrate that US has high specificity but lower sensitivity than other imaging modalities. With US, metastases can be hypoechoic, hyperechoic, cystic, or diffuse. Doppler may be useful, particularly in vascular lesions such as neuroendocrine tumors, sarcomas and lymphomas. Metastases frequently displace normal liver vessels.

Intraoperative/Laparoscopic Ultrasound

Intraoperative ultrasound (IOUS) is the most accurate imaging technique for detecting liver metastases at the time of primary tumor resection or resection of known metastases. It is complementary to surgical inspection and palpation. Additionally, intraoperative US can be important for localization of tumors for ablative techniques or to guide intraoperative biopsy or surgical resection. Laparoscopic US (LUS) has been developed as an alternative to open intraoperative US with promising results. In one study of 55 patients with primary and secondary liver neoplasms who underwent LUS as part of a tumor ablation procedure, LUS demonstrated all 201 liver tumors shown by triphasic CT and an additional 21 lesions not shown by CT.

Computed Tomography

CT is particularly suited for the evaluation of metastatic disease, because the liver and potential extra-hepatic sites of tumor spread can be evaluated during the same examination. Helical CT is the preferred examination in the United States for surveillance for metastatic disease after treatment of the primary neoplasm, with multidetector CT representing the current state of the art. Because most hepatic metastases are relatively hypovascular compared with normal liver parenchyma, the lesions are hypoattenuating when imaged during the peak of hepatic parenchymal enhancement (portal venous phase). In general, therefore, imaging during the portal venous phase of hepatic enhancement is adequate to detect most hepatic lesions in most patients.

Hypervascular lesions are less common, and tumors in this group include metastases from renal cell carcinoma, carcinoid, islet cell carcinoma, thyroid carcinoma, melanoma, and neuroendocrine tumors. In a large series of patients, small (<2 cm) hypervascular lesions were seen better in the arterial phase than in the portal venous phase. With the widespread use of multidetector row scanners, arterial phase scanning can be routine. Although metastases from breast carcinoma are sometimes hypervascular, one study showed that arterial phase imaging was not necessary in this group. Hypervascular lesions may be

isoattenuating to liver during the portal venous phase of hepatic enhancement. With helical CT, both arterial and portal venous phase imaging is recommended for patients with hypervascular primary tumors. If helical CT is not available, a noncontrast scan can also be useful.

CT arterial portography is no longer used extensively, as it is an invasive angiographic technique that often yields confusing artifacts that decreases accuracy. Newer arterial mapping techniques using MR and CT angiography have largely replaced standard angiographic techniques for preoperative staging.

When CT is used to characterize a liver lesion detected with US, the CT examination should include arterial phase and porta venous phase imaging. Many incidentally discovered liver lesions are hypervascular and therefore may be demonstrated and/or characterized accurately only if arterial phase imaging is included.

Magnetic Resonance Imaging

With MRI, most hepatic metastases, like most liver lesions, are hypointense to normal liver on T1-weighted images and hyperintense to liver on T2-weighted images. Some morphologic features have been shown to be useful in distinguishing metastatic lesions from common benign lesions such as hemangiomas and cysts. Findings in metastatic disease include heterogenous signal intensity with an irregular or indistinct outer margin, smooth or irregular central areas of high signal intensity surrounded by a ring of low signal intensity, or a mass surrounded by a ring of high signal intensity. On T2-weighted images, hemangiomas are hyperintense compared with normal liver parenchyma and generally higher in signal intensity than metastases. The typical early enhancement pattern of hemangiomas after administration of gadolinium chelates is eccentric, nodular peripheral enhancement. When present, this pattern, which is similar to that seen with contrast enhanced CT, is highly accurate in distinguishing hemangiomas from metastases.

Several studies have compared the accuracy of various MR techniques to other standard imaging modalities. A large clinical trial in the Radiology Diagnostic Oncology Group (RDOG) series compared MR to CT in metastatic colorectal cancer to the liver. CT had a higher sensitivity and similar specificity as compared to MR. Rapid imaging with breath holding has been found to be more sensitive for hepatic masses than conventional non-breath-hold spin-echo techniques.

There is continued debate about the value of MR contrast agents. One study showed gadolinium chelate-enhanced 3D rapid gradient echo imaging to be superior to unenhanced MR imaging for detecting focal hepatic masses. Another study, however, demonstrated no statistically significant difference between unenhanced and gadolinium-enhanced MR imaging in differentiating patients with liver metastases from those without metastases. Nevertheless, most experts in body MR imaging consider gadolinium chelate enhancement to be an essential part of the abdominal MR imaging examination of colorectal cancer patients being evaluated for possible liver metastases. A report in 51 patients suggests that MR with superparamagnetic iron oxide contrast (SPIO) may be slightly superior to dual-phase CT for patients with colorectal metastases.

Nuclear Imaging

Positron emission tomography (PET) has become more widely used in detecting metastatic disease. A meta-analysis comparing US, CT, MRI, and 18F fluorodeoxyglucose (FDG) PET in patients with cancers of the gastrointestinal tract concluded that FDG-PET is the most sensitive imaging test for the diagnosis of hepatic metastases from colorectal cancer. In addition, several studies have demonstrated that the addition of FDG-PET to a conventional staging evaluation in colorectal cancer patients with potentially resectable liver metastases results in a change in management of 20%-32%, mainly due to detection of unknown extrahepatic disease. PET also has been shown to be accurate in distinguishing benign from malignant liver tumors. A limitation of FDG-PET, however, is that it may fail to demonstrate small (< 1 cm) liver metastases. For staging and restaging patients with colorectal liver metastases, integration of CT and FDG-PET data, either by fusion or by integrated PET-CT imaging, enables better management guidance than with either technique alone.

Traditional reticulo-endothelial imaging or blood pool imaging can be useful for characterizing masses such as focal nodular hyperplasia or hemangioma but are not typically used for detecting metastatic disease. Newer agents such as isotope-tagged monoclonal antibodies directed toward surface proteins expressed by colorectal liver metastases have had some initial success in solving difficult clinical problems. Liver metastases from endocrine active tumors from the pancreas or gastrointestinal tract can be detected by somatostatin receptor scintigraphy.

Summary

Many radiologic techniques are available for preoperative detection of liver metastases and postoperative surveillance. Some of the less widely used screening techniques can be useful when there is a need for specific problem solving. Rapid technological and clinical advances in equipment, contrast agents, and radioisotopes make direct comparison of the various techniques difficult. In addition, local custom and equipment availability within communities or medical centers can be expected to lead to a variety of indications and applications in detecting of hepatic metastatic disease.

Abbreviations

- CT, computed tomography
- CTA, computed tomography angiography
- CTAP, computed tomography arterial portography
- HAP, hepatic arterial phase
- INV, invasive
- MRI, magnetic resonance imaging
- NUC, nuclear medicine
- PET, positron emission tomography
- PVP, portal venous phase
- US, ultrasound

CLINICAL ALGORITHM(S)

Algorithms were not developed from criteria guidelines.

EVIDENCE SUPPORTING THE RECOMMENDATIONS

TYPE OF EVIDENCE SUPPORTING THE RECOMMENDATIONS

The recommendations are based on analysis of the current literature and expert panel consensus.

BENEFITS/HARMS OF IMPLEMENTING THE GUIDELINE RECOMMENDATIONS

POTENTIAL BENEFITS

Selection of appropriate radiologic imaging procedures for evaluation of patients suspected of liver metastases

POTENTIAL HARMS

Not stated

QUALIFYING STATEMENTS

QUALIFYING STATEMENTS

An American College of Radiology (ACR) Committee on Appropriateness Criteria and its expert panels have developed criteria for determining appropriate imaging examinations for diagnosis and treatment of specified medical condition(s). These criteria are intended to guide radiologists, radiation oncologists, and referring physicians in making decisions regarding radiologic imaging and treatment. Generally, the complexity and severity of a patient's clinical condition should dictate the selection of appropriate imaging procedures or treatments. Only those exams generally used for evaluation of the patient's condition are ranked. Other imaging studies necessary to evaluate other co-existent diseases or other medical consequences of this condition are not considered in this document. The availability of equipment or personnel may influence the selection of appropriate imaging procedures or treatments. Imaging techniques classified as investigational by the U.S. Food and Drug Administration (FDA) have not been considered in developing these criteria; however, study of new equipment and applications should be encouraged. The ultimate decision regarding the appropriateness of any specific radiologic examination or treatment must be made by the referring physician and radiologist in light of all the circumstances presented in an individual examination.

IMPLEMENTATION OF THE GUIDELINE

DESCRIPTION OF IMPLEMENTATION STRATEGY

An implementation strategy was not provided.

IMPLEMENTATION TOOLS

Personal Digital Assistant (PDA) Downloads

For information about availability, see the "Availability of Companion Documents" and "Patient Resources" fields below.

INSTITUTE OF MEDICINE (IOM) NATIONAL HEALTHCARE QUALITY REPORT CATEGORIES

IOM CARE NEED

Living with Illness

IOM DOMAIN

Effectiveness

IDENTIFYING INFORMATION AND AVAILABILITY

BIBLIOGRAPHIC SOURCE(S)

Heiken JP, Bree RL, Foley WD, Gay SB, Glick SN, Huprich JE, Levine MS, Ros PR, Rosen MP, Shuman WP, Greene FL, Expert Panel on Gastrointestinal Imaging. Suspected liver metastases. [online publication]. Reston (VA): American College of Radiology (ACR); 2005. 8 p. [28 references]

ADAPTATION

Not applicable: The guideline was not adapted from another source.

DATE RELEASED

1998 (revised 2005)

GUIDELINE DEVELOPER(S)

American College of Radiology - Medical Specialty Society

SOURCE(S) OF FUNDING

American College of Radiology (ACR) provided the funding and the resources for these ACR Appropriateness Criteria®.

GUIDELINE COMMITTEE

Committee on Appropriateness Criteria, Expert Panel on Gastrointestinal Imaging

COMPOSITION OF GROUP THAT AUTHORED THE GUIDELINE

Panel Members: Jay P. Heiken, MD; Robert L. Bree, MD, MHSA; W. Dennis Foley, MD; Spencer B. Gay, MD; Seth N. Glick, MD; James E. Huprich, MD; Marc S. Levine, MD; Pablo R. Ros, MD, MPH; Max Paul Rosen, MD, MPH; William P. Shuman, MD; Frederick L. Greene, MD

FINANCIAL DISCLOSURES/CONFLICTS OF INTEREST

Not stated

GUIDELINE STATUS

This is the current release of the guideline.

This guideline updates a previous version: Bree RL, Greene FL, Ralls PW, Balfe DM, DiSantis DJ, Glick SN, Kidd R, Levine MS, Megibow AJ, Mezwa DG, Saini S, Shuman WP, Laine LA, Lillemoe K. Suspected liver metastases. American College of Radiology. ACR Appropriateness Criteria. Radiology 2000 Jun;215(Suppl):213-24.

The appropriateness criteria are reviewed annually and updated by the panels as needed, depending on introduction of new and highly significant scientific evidence.

GUIDELINE AVAILABILITY

Electronic copies: Available in Portable Document Format (PDF) from the American College of Radiology (ACR) Web site.

ACR Appropriateness Criteria® Anytime, Anywhere™ (PDA application). Available from the ACR Web site.

Print copies: Available from the American College of Radiology, 1891 Preston White Drive, Reston, VA 20191. Telephone: (703) 648-8900.

AVAILABILITY OF COMPANION DOCUMENTS

The following is available:

- ACR Appropriateness Criteria®. Background and development. Reston (VA): American College of Radiology; 2 p. Electronic copies: Available in Portable Document Format (PDF) from the American College of Radiology (ACR) Web site.

PATIENT RESOURCES

None available

NGC STATUS

This summary was completed by ECRI on March 19, 2001. The information was verified by the guideline developer on March 29, 2001. This NGC summary was updated by ECRI on January 26, 2006.

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DISCLAIMER

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